Michael. I cannot agree with analysing ad hocness₂.

p 4-5
certainly not your claim that this is "just what a scientist means when he says that T was an ad hoc expln ..."

p 11-13. methodological decisions.
I am v. dubious about the necessity of this.

13 analogy with verisimilitude unfortunate

15 memory factor seems pretty arbitrary.
Lakatos would hold that it is not alternative refutations but a long sequence of successive refutations that causes degeneration.
Also reason why a success wipes out the same previous refutations is due to theoretical connection between the success and a particular sequence of refutations, as in Lakatos' examples. The sequence of related predictions must relate to a particular anomaly.

19 logarithmic plot needed so as to prevent Plateau getting too close to 1.

p 13-15 ~~There~~ I can prove there exists a solution ~~(probably two distinct ones)~~ to eqns 1-7. Let $r_A = \frac{B + k(1-B)}{AB + k(1-AB)}$, let $r_B = \frac{A + k(1-A)}{AB + k(1-AB)}$

solve the eqn: $r = \frac{(B+k(1-B))(A+k(1-A))}{[AB+k(1-AB)]^2}$ (for k in terms of r) and substitute in the eqns for r_A, r_B. The final eqn is not at all simple

~~I cannot prove this necessarily~~ always has a soln for the relevant values of A and B, but numerical examples seem to suggest this.

wls

Michael Redhead Flat 9, 11 West Central Street, London WC1A 1JP.
Noretta Koertge 3.11.75.

Dear Michael,

Thank you for your manuscript on Comparative Theory Evaluation. I have a number of detailed comments, but there is one quite general point which both you and Noretta seem to have overlooked. This is that Bayesian personalism explains the Lakatos asymmetry between the effect of confirming and disconfirming evidence on a well-established research programme <u>without</u> recourse to any extra ad hoc methodological rules such as "leave the hard core unchanged in the event of disconfirmation but modify one of the hypotheses in the protective belt"; also there is no need to introduce an ad hoc 'memory' in order to ensure that a sufficiently long sequence of disconfirming instances eventually leads to abandonment of the hard core and hence of that research programme.

Let T be the hard core and H a particular hypothesis in the protective belt. Let E be a disconfirming piece of evidence, suppose for example that $T.H \rightarrow -E$. Suppose no plausible rival theory predicts E, and that E is an unlikely event which has an intrinsic probability of about 1/1000, before we take into account the relation $T.H \rightarrow -E$, which will lower it further. Let T be the hard core of a fairly well-supported theory and suppose initially $p(T) = 0.95$. (If you want to write this as $p(T,B) = 0.95$, where B is background information, you can do so, but since B would then appear in all my formulae, I shall leave out B for simplicity of notation.) Let H be a plausible but by no means established hypothesis in the protective belt, suppose for example that $p(H)=0.6$. (Again you can write this $p(H,B)$ if you want to.) Suppose also for convenience that $p(H.T)=p(H)p(T)$, i.e. that these are subjectively statistically independent hypotheses. Then I shall show that the evidence E drastically reduces the probability of H, but only slightly reduces the probability of T, just as Lakatos would require. Also that sufficiently many successive pieces of disconfirming evidence like E would reduce the probability of T to less than 1/2. Also that there is an asymmetry between confirmation and disconfirmation, in that if we consider a different piece of evidence E', such that $T.H \rightarrow E'$, so E' is confirming evidence, but otherwise things are the same, then E' very strikingly increases the probabilities of both T and H. So, just as Lakatos requires, the occasional success can more than make up for quite a number of 'refutations'.

$$
\begin{aligned}
\text{Now } p(E,T) &= p(E,T.H)p(H) + p(E,T.-H)p(-H) \\
&= 0 \times .6 + .001 \times .4 \\
&= .0004. \\
p(E,-T) &= .001
\end{aligned}
$$

(I take both $p(E,-T)$ and $p(E,T.-H)$ as 1/1000, which I called the 'intrinsic' probability of the unlikely event E, because I assume we know nothing about any entailment relations in these cases.)

$$
\begin{aligned}
\text{It follows that } p(E) &= p(E,T)p(T) + p(E,-T)p(-T) \\
&= .0004 \times .95 + .001 \times .05 \\
&= .00038 + .00005 \\
&= .00043.
\end{aligned}
$$

$$
\begin{aligned}
\text{Now } p(T,E) &= p(E,T)p(T)/p(E) \\
&= .0004 \times .95/.00043 \\
&= .00038/.00043 = 38/43 = 76/86 = .88 \text{ approximately.}
\end{aligned}
$$

Therefore the evidence E only slightly reduces the probability of T, as Lakatos requires.

$$
\begin{aligned}
\text{But } p(E,H) &= p(E,H.T)p(T) + p(E,H.-T)p(-T) \\
&= 0 \times .95 + .001 \times .05 \\
&= .00005.
\end{aligned}
$$

$$
\begin{aligned}
\text{So } p(H,E) &= p(E,H)p(H)/p(E) \\
&= .00005 \times .6/.00043 \\
&= .00003/.00043 = 3/43 = 6/86 = .07 \text{ approximately.}
\end{aligned}
$$

Therefore the evidence E drastically reduces the probability of H, as Lakatos requires, without our needing any special Lakatosian methodological rule to achieve this asymmetry between the effect of E on T and H.

It is clear that similar refutations of T.H', for a succession of H"s, and new pieces of evidence related to T and H' as E was to T and H, would eventually lower the posterior probability of T to less than a half, or indeed to as low a figure as one would wish, and hence lead to the abandonment of the research programme embodying T.

Consider on the other hand the effect of a confirming piece of evidence E', with $T.H \rightarrow E'$. Suppose the prior probabilities of T and H as before and suppose the 'intrinsic' probability of E' again 1/1000.

$$
\begin{aligned}
\text{Then } p(E',T) &= p(E',T.H)p(H) + p(E',T.-H)p(-H) \\
&= 1 \times .6 + .001 \times .4 \\
&= .6004
\end{aligned}
$$

$$
\begin{aligned}
p(E') &= p(E',T)p(T) + p(E',-T)p(-T) \\
&= .6004 \times .95 + .001 \times .05 \\
&= .57038 + .00005 \\
&= .57043
\end{aligned}
$$

$$
\begin{aligned}
p(T,E') &= p(E',T)p(T)/p(E') \\
&= .6004 \times .95/.57043 \\
&= .57038/.57043 = 1 - 5/57043 = .99992 \text{ approximately.}
\end{aligned}
$$

So confirming evidence of this kind drastically increases the probability of T.

$$
\begin{aligned}
\text{Also } p(E',H) &= p(E',H.T)p(T) + p(E',H.-T)p(-T) \\
&= 1 \times .95 + .001 \times .05 \\
&= .95005 \\
\text{So, } p(H,E') &= p(E',H)p(H)/p(E') \\
&= .95005 \times .6/.57043 \\
&= .57003/.57043 = 1 - 40/57043 = .9993 \text{ approximately.}
\end{aligned}
$$

So this confirmation also drastically increases the probability of H.

So everything that Lakatos might require already follows from a straight-forward BAYESIAN analysis without regard to arbitrary additional methodological rules;

JON DORLING.